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PATENT SPECIFICATION

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(54) METHOD AND APPARATUS FOR PRODUCING PLASTIC-COVERED CONTAINERS

(71) We, OWENS-ILLINOIS INC., a corporation organised under the laws of Ohio, United States of America, of Toledo, Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

10 The invention relates to method and apparatus for producing a base article, such as a container, with a shrunken, surface covering of plastic thereon. While conveyed in axial registry with each other, a sleeve 15 form of shrinkable plastic is telescopically assembled onto the article by a cam-operated push-up element and held in place until the article and sleeve enter a heating device for applying heat to a relatively 20 narrow, band-like region of the sleeve about the article causing the plastic of that region to shrink into gripping engagement with the article to hold the sleeve in place until the next step of the process, e.g. the total heat 25 shrinking of the sleeve on the article. The heating device structure is comprised of opposed elongated nozzles through which hot air at preferably 200—900° F is applied in a narrow horizontal pattern. The article is 30 conveyed between the opposed nozzles, and during travel therethrough the article is rotated.

The invention relates to the manufacture 35 of containers in which a preliminary sleeve form, usually a hollow right cylinder form of a foamed plastic material, is telescopically placed over an article of basic shape and shrunk thereon into article conformity.

40 The invention comprises an improvement of the method performed in U. S. Patent No. 3,767,496 and the apparatus disclosed in co-pending application Serial No. 209,751 filed December 20, 1971, now U. S. Pat. No. 3,802,942 both of common ownership with the present application.

In the process and apparatus for making 45 plastic coated, composite containers, such as is disclosed in U. S. Patent No. 3,760,968,

a manufactured glass bottle is loaded onto a conveyor and transported through a pre-heat apparatus whereat the temperature of the bottle is increased to 175°—300°F. Upon leaving the pre-heat apparatus, the conveyor is guided in a horizontal path around an arcuate end-turn in which plastic sleeves carried on an underlying turret register with the bottles and are moved vertically in a telescopic assembly over the lower ends of the bottles. From that point of assembly, the sleeves are carried on the bottles as the conveyor moves into a heating apparatus, such as a tunnel oven, wherein the temperature, maintained on the order of 175°—800°F, depending on the composition of the plastic of the sleeves, shrinks the sleeves into a snug fitting, conforming relationship over the bottle surface where assembled.

At low production rates, i.e. conveyor speeds, the sleeve will initially shrink enough on the pre-heated bottles to travel from the turret assembly point to the oven without slipping or otherwise dislocating itself on the bottle. Production speeds over 200 bottles per minute may cause some dislocation of the sleeve members from initial assembly. It is, therefore, one of the important objects of the present invention to provide a method and means to positively secure the sleeve in the initial telescopic assembly position on the base article to prevent dislocation of the sleeve before overall shrinking even at high production speeds, i.e. in excess of 200 B.P.M.

Another object of the invention is to provide such method and apparatus for assuring against dislocation without increasing pre-heat temperature of the base article over values in current practice; or without the use of external handling mechanism engaging the sleeve to hold it in place between the turret assembly point and the shrink oven.

The present invention, as is disclosed hereinafter in terms of a specific, preferred embodiment, provides a step in the method

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of applying a relatively narrow elongated band of heat onto the sleeve exterior at the time the latter is assembled onto the base article being carried by the conveyor, and 5 thereafter for a finite distance in travel toward the shrink oven. The heat is preferably furnished by hot air applied from opposed nozzle banks on either side of the path of the article and closely adjacent thereto. The nozzles are positioned at the proper elevation for zonally shrinking a band region of the sleeve about an adjacent band-like part of the bottle for holding it rather firmly thereon until the sleeve and 10 article travel the sufficient distance into the final heating treatment for complete, overall shrinking of the sleeve on the base article form.

The apparatus provides an arcuate nozzle 20 means conforming to a portion of the conveyor arcuate path, as disclosed herein, and in its broadest sense, the heating means corresponds to the conveyor path in a portion it takes just after the sleeve is telescoped to 25 assembly position by the turret means that handles the sleeve up to that point.

Another feature of the invention is the provision of means for rotating the bottle just as the sleeve is released to it by the 30 turret apparatus for evenly applying the heat for shrinking a band portion of the sleeve about the bottle as the two are conveyed through the opposed nozzles.

A further feature in the apparatus improvement of this invention is the provision 35 of an extended dwell time in the raising motion of the turret machine stripper element or sleeve push-up to assure an overlap in time of the cycle between assembly of 40 the sleeve over the bottle to the fully raised position and the entry of the bottle and sleeve into the zonal heat application. Since the push-up element is cam operated, the improved apparatus of the invention will insure some cam-dwell time after raising the 45 sleeve to full elevation on the bottle before the sleeve push-up element is cammed downwardly (retracted).

Several other attendant objects and 50 advantages of the invention will become apparent to those skilled in the art from the description and drawings of the invention, as will presently appear herein.

FIGURE 1 is a three-quarter front perspective view of a machine for applying plastic sleeves onto glass bottles, and incorporates the improvements of the present invention:

FIGURE 2 is a sectional elevational view 60 taken on a line 2—2 on Fig. 1;

FIGURE 3 is a fragmentary elevational view taken on a line 3—3 on Fig. 1 of the bottles and the radially innermost sleeve tacking nozzle of the invention;

65 FIGURE 4 is a fragmentary elevational

view like Fig. 3 but taken on a line 4—4 on Fig. 1 of the bottles and the radially outermost sleeve tacking nozzle of the invention; and

FIGURE 5 is a spatial perspective view, 70 partly broken away, showing the relationship of the plastic sleeve on the glass bottle after it traverses the sleeve tacking nozzle apparatus on the machine of Fig. 1.

Shown on Fig. 1 is a machine for producing plastic sleeves on a turret machine 10, assembling them telescopically over rigid base articles carried by the conveyor 11 and shrinking them thereon in a heating apparatus 12. The rigid base articles in the examples of the present disclosure are the glass bottles B; and, after having a shrunken plastic covering thereon, form a composite package of the type described and shown in U. S. Patent No. 3,760,968.

The bottles B are fed to and loaded on neck gripping overhead chucks 13 connected to an endless driven device comprised of upper and lower chains 14 and 15, respectively, extending around end-turn gears 16 and 17 each keyed onto the vertical shaft 18. A bull gear 19 is also connected at the upper end of shaft 18 in mesh with drive gear 20 connected to the power drive means (not shown) by the drive shaft 21. Power is transmitted to gear 19 to rotate it and shaft 18 counter-clockwise on Fig. 1 and drive the chains 14, 15 in a counter-clockwise direction through the endless path of the conveyor. Chucks 13 are mounted on carriage brackets 22 connected to links of the chains 14, 15. The several carriage brackets have spaced rollers 23 on their back sides running in stationary tracks 24 and 25 around the path of the conveyor. The chucks 13 are each vertically, slidably mounted on their respective carriage brackets 22 and the vertical elevation of chucks 13 is controlled by the cam roller 26 rotatably connected to the upper element 13a of the chuck running in cam track 27 fastened rigidly on the machine. The chucks 13 have three lower jaws 13b which open and close about the top end of bottle B. The jaws 13b are attached to a circular arbor including a wheel element 13c that is rotatable about shaft 13d of the chuck so that friction engagement of the periphery of the wheel element 13c of the arbor with a stationary element (to be described herein-after) anywhere along the path of the conveyor imparts rotation of the chucks and bottles thereon about the axis of the shaft 13d.

The end turn portion of the conveyor mechanism is supported by the upper frame 28 rigidly supported on the front wall of the oven 12.

Beneath the conveyor end-turn portion, just described, is the rotary sleeve turret 130

machine 10 which is coaxial with the vertical shaft 18. Turret machine 10 is comprised of an upper annular turret 10a rotated counterclockwise about shaft 10b over the lower stationary frame 10c. The turret machine 10 includes a plurality of spaced mandrels 29 mounted on turret 10a whose peripheral spacing on turret 10a coincides radially and with the peripheral spacing of chucks 13 in the end-turn portion of the conveyor path. The chucks 13 have their centers in registry with the vertical central axes of underlying mandrels 29. At the base of each mandrel in an inactive position there is an annular, encircling push-up bar or stripper element 30 connected to a vertical operating rod 31 by an arm. Rods 31 are each vertically slidable on the guides 32 connected with turret 10a and under control of the circular cam 33 extending around frame 10c in which a cam roller 33a connected to rod 31 is in running engagement. The cam 33 is a stationary element of turret frame 10c. The pattern of the rise and fall of cam 33 provides the proper vertical reciprocating motion to rod 31 and push-up bar 30 responsive to rotary movement of turret 10.

Connected for operation with turret machine 10 is mechanism for feeding a supply of plastic strip stock and forming it to sleeve lengths. The strip stock is shown as a running web 34 guided through opposed feed rollers 35, 36 and onto the sleeve drum 37. The web 34 on drum 37 has forward lengths cut therefrom by rotary knife 38, and the cut lengths 34a are held onto drum 37 by vacuum until the leading edge thereof engages a mandrel 29 of turret 10a. The mandrel at this point is engaged by its drive means of the turret machine to rotate it more than 360° winding the strip 34a about a mandrel 29 in an end-to-end overlap of the strip to form a cylindrical shape. Thereafter, means on the turret machine connect the overlapped ends at a vertical seam to complete formation of a cylindrical, hollow sleeve S of the plastic material.

An example of the plastic material is given in the aforementioned Patent No. 3,767,496 which, briefly stated, comprises a polystyrene or other thermoplastic that is highly orientated in the longitudinal dimension of the web (circumference of sleeve S) in relation to any orientation of the plastic in the transverse dimension (height of sleeve S). Examples of material that may be run in form of web 34 are foamed polystyrene on the order of 0.010-0.018 inch thickness or foamed polyethylene on the order of 0.008-0.015 inch thickness. Both are highly oriented in the running direction of web 34.

The inner circumference of sleeve S is slightly more than the exterior circumference of the article B so that the sleeve S may be telescopically applied over article B

to a desired elevation on the latter. The preferred thermoplastic may be of foamed structure and such a material on the order of 10 thousandths of an inch or greater in thickness provides a suitable sleeve S for handling on the machine.

After the plastic strip 34a is wound on mandrel 29 and seamed to form sleeve S, the mandrel 29 and chuck 13 travel together through an assembly station during which the two are at zero angular velocity and displacement with respect to each other. In this span of travel, roller 33a begins its rise on cam 33, and push-up bar 30 rises on mandrel 29, which elevates sleeve S into telescopic assembly on bottle B. Sleeve S is supported thusly by push-up bar 30 during the flat span A of cam 33. Just after the point represented by the dashed line T in Figure 1 where bottle B and sleeve S thereon enter the space between the opposed nozzle means 39a and 39b, the cam 33 falls away and push-up bar 30 is retracted from supporting contact with sleeve S.

As shown on Figs. 2-4, the elongated nozzle means 39 comprises two opposed hot air nozzles that are contoured to the path the article B must take in its carriage beyond the point where the plastic sleeve is assembled over article B. The outside nozzle member 39a is supported on vertical members 40 secured to the turret frame 10c (Fig. 1). The inside nozzle member 39b is disposed radially inwardly from the member 39a and is substantially parallel thereto, member 39b being supported on vertical standards 41 connected to the overhead frame 28 of the conveyor.

Nozzle member 39a has an inwardly facing, arcuate concave face 42 having an elongated slot 43 formed through the face and in communication with chamber 44; the latter being formed by the bottom wall 45, outer vertical side wall 46 and the top wall 47. The outer vertical wall 46 and inner face 42, at their respective end extremities, are joined to close the chamber 44 on all sides except for slot 43. Top wall 47 has an upstanding, circular pipe wall 48 defining opening 49 into chamber 44. Opening 49 is connected to a source of heated air or gaseous media (to be described) via flexible conduit 50 encircling wall 48.

Nozzle member 39b is somewhat similarly constructed to include an arcuate, convex face 51 that correspondingly parallels and opposes face 42 of the other member 39a, just described. Face 51 includes an elongated slot 52 that is situated at the same elevation as the opposite slot 43. The space between the convex face 51 and the concave face 42 is slightly greater than the diameter of the combination of bottle B with sleeve S in place thereon (see Fig. 2). Slot 52 communicates with interior chamber 53 defined 130

by bottom wall 54, back wall 55 and top wall 56. The end extremities of back wall 55 and face 51 are connected to close the chamber 53 except for slot 52. An upwardly angled circular pipe wall 57 is connected into the top wall 56 and back wall 55 providing an opening 58 connecting into chamber 53, and a flexible conduit 59 encircles wall 57 for connecting the source of heated air or gaseous media into chamber 53.

Although nozzle openings are shown and described as slots 43 and 52, other nozzle forms will be suitable as alternative constructions, such as for example, plural, aligned slots, perforations along the nozzle face or a series of jets. The nozzle means of the invention embodies the various constructions which may functionally apply the opposed band heat to the plastic sleeve as the latter moves along the former.

The conduits 50 and 59 (Fig. 1) are connected at the Y-connector pipe 60 that is a part of pipe 61. A gas-fired burner 62 has its outlet connected to the opposite end of pipe 61 and gaseous hydrocarbon fuel or natural gas is furnished to burner 62 by fuel line 63 through regulator 64 and into the burner manifold. The fuel is ignited and burned in the known manner in burner 62 to furnish heated air at the outlet to pipe 61. Air in regulated volume is furnished to the burner by the blower 65 mounted on top of the oven chamber 12 and powered by an electric motor indicated at 66 connected to rotate blower 65. The outlet 67 of blower 65 is connected into the air intake of burner 62 by pipe 68. The blower 65 is operated in conjunction with burner 62 to supply the heated air into chambers 44 and 53 of the nozzle members 39a and 39b through conduits 50 and 59, respectively, at temperature in the range 200—900° F and approximately 500 cfm. This heated air is forced through nozzle slots 43 and 52 (Fig. 2) and onto an exterior band region of sleeve S over bottle B. The heat is sufficient to promptly shrink the aforementioned plastic material of a band-like region of sleeve S firmly about the bottle B and hold the sleeve in its place thereon at proper elevation.

At the underside of the carriage frame below guide rail 25 (Figs. 1 and 2) there is mounted a friction rail 72 supported by cantilevered brackets 73. Friction rail 72 has an arcuate front surface that conforms with the path the chucks 13 will travel past nozzles 39a and 39b. The friction rail 72 thereby engages the periphery of the annular driving (wheel) element 13c of each of the chucks 13 just as they enter the space between nozzles 39a, 39b and the rail extends along the span of the nozzles in the conveyor path. At the time the wheel element 13c engages rail 72, rotation is imparted to the chuck 13 by the wheel rolling

on the rail 72 along its length. The length of the rail may be varied to obtain desired amount of rotation. By rotation of the article during its traverse of the nozzle means, heat is applied more evenly in the annular band-like region around the sleeve.

As shown on Figs. 3—5, this bank-like region is shown by the pinched region 70 (exaggerated in extent on the drawings for clarity of illustration). The relationship of sleeve S on article B after traversing the nozzles 39a, 39b is illustrated in the sectioned view of Fig. 5, wherein a bottle B has a cylindrical sleeve S of a shrinkable plastic thereon, a narrow annular bank-like region 70 of the sleeve being shrunk (pinched) into firm band-like engagement with the exterior bottle surface, thereby holding the sleeve in place for travel from the nozzles (Fig. 1) into the final heating device 12.

The heating device 12 may be one of several available sources of heat, such as, heated air circulated across the tunnel 12a, banks of infrared heater elements, such as lamps or resistance (cal-rod) heater elements, etc. The heat applied to the sleeves comprised of a foamed polystyrene of the thickness herein mentioned, during longitudinal travel of tunnel 12a is on the order of 400° F for a period of 4—6 seconds. For different compositions or densities, thicknesses, etc. of the plastic material, this heat may be altered accordingly to perform the shrinkage. But, this second heat shrinkage treatment applied on the sleeve shrinks all of the sleeve S into conforming relationship snugly over the bottle B where applied.

Thus, the method herein employed utilizes two heat applications to the sleeve after it is placed on the base article, one a partial or zonal heat for securing the sleeve in place, and the second, a complete and overall heat for shrinking the sleeve into a conforming covering of the article where applied.

Other forms of heating devices may be used in connection with or as replacements for the hot air nozzles; the latter being disclosed as the preferred mode of the invention because of its satisfactory performance and economy of operation.

The preferred mode of operation, as described hereinabove, includes the step in the method and the apparatus on the machine for rotating the articles B by the chucks during travel through the length of nozzles 39a, 39b. The rotation principle gives optimum results; however, the method and apparatus will function satisfactorily, i.e. the sleeve will be secured in place on the article for further transport, without the rotation of the article through the heat applying nozzle means 39.

In Figure 1, the heating apparatus 12 includes a pre-heat tunnel 12b through 130

which bottles B may be initially conveyed for pre-heating the articles prior to plastic sleeve assembly. This pre-heating step is described in the said U.S. Patent No. 5 3,767,496.

Other and further modifications may be resorted to without departing from the scope of the appended claims.

WHAT WE CLAIM IS:—

- 10 1. An apparatus for assembling tubular, plastic sleeves telescopically onto base articles, having a turret and plural spaced mandrels thereon, a base article conveyor with plural spaced chucks thereon carrying said articles in a path over the mandrels to receive a sleeve on each, a final heating device into which the conveyor transfers the sleeve covered base articles for shrinking the sleeves onto said articles and a stripper means operable for moving a sleeve from its mandrel onto an overhead base article at an assembly station on the turret, elongated nozzle means extending along said path toward said heating device and adjacent to said assembly station, a source of heat, and means connecting the source of heat and the elongated nozzle means for directing heat onto the sleeve on each base article, thereby shrinking a portion of the sleeve initially on the base article sufficiently to hold the sleeve in position thereon during travel through the balance of said path to said final heating device.
- 15 2. The apparatus defined in claim 1, wherein said base articles comprise glass bottles.
- 20 3. The apparatus defined in claim 2, wherein the path described by said turret and the bottle conveyor includes an arcuate portion, and said nozzle means is positioned in said arcuate portion of said path.
- 25 4. The apparatus defined in claim 3, wherein the nozzle means comprises opposed arcuate extending nozzles defined by opposed arcuate facing members spaced on either side of said arcuate path portion, and an elongated slot through each of the opposed facing members, thereby providing opposed nozzles for applying said heat, a chamber means communicating with each of the nozzles, the heat source comprising heated air, and means connecting each of the chamber means to said heated air source, the bottles, passing between said nozzles after receiving a sleeve thereon.
- 30 5. The apparatus defined in claim 3, wherein said source of heat is heated air including a means for pressurizing the heated air, the nozzle means comprises opposed chambers having arcuate, complementary facing surfaces on either side of said arcuate path portion and spaced from each other an amount slightly greater than the diametrical dimension of the sleeve on

the bottle, elongated, narrow slot means in each of said chamber facing surfaces, and means connecting the pressurized, heated air to each of said chambers for applying heat by the elongated slot means of the opposed nozzle chambers onto the sleeve, whereby a band portion of the sleeve is shrunk into firm contact with the underlying bottle.

6. The apparatus defined in claim 1, wherein said plural spaced chucks are rotatably mounted on the article conveyor and said improved apparatus includes a means engageable with said rotatable chucks as they move in said path past said assembly station and said elongated nozzle means for rotating the chucks and articles thereon during the application of heat to the sleeves on the articles by said nozzle means.

7. The apparatus defined in claim 6, wherein each of said chucks includes an annular driving element coaxially connected to said chuck, and said means engageable with said chucks comprises a friction rail corresponding to the said path adjacent said assembly station, and means supporting said rail along said path adjacent the assembly station and along the nozzle means span thereof for successively rotating the chucks about their axes responsive to movement of the articles past the nozzle means.

8. The method of forming an encircling plastic covering on elongated base articles comprising:

conveying base articles in a first path with their longitudinal axes perpendicular to the direction of movement,

moving hollow body sleeves of a heat shrinkable plastic material in a separate, second path spaced from the articles, a portion of said second path being parallel with said first path so that the central longitudinal axes of said sleeves are substantially in a coaxial relationship with said articles, the sleeves having an interior cross dimension slightly larger than the exterior cross dimension of said articles,

during said movements, telescopically transferring a sleeve over each article by movement in said coaxial direction to a position whereat the sleeve is placed over at least a portion of the article for movement with the latter in said first path,

conveying the transferred sleeve and article together in said first path through a subsequent portion thereof past a zonal heating device for applying heat to an annular exterior band region of the sleeve, thereby shrinking said annular band of the sleeve onto the article holding the sleeve in place on the article,

conveying the sleeve and article further in said first path into and through a heat applying device, and

applying heat to said sleeve sufficient to

- completely shrink it into a snug, conforming, encircling relationship on the surface of said article.
9. The method of making a container having an encircling plastic covering thereon comprising conveying containers in line in an upright position along a first path, moving heat shrinkable plastic sleeves in line in an upright position along a second path that includes a portion in underlying axial registry with containers being conveyed along said first path, transferring the registered sleeves to overly the respective containers while in registry in said first and second paths, holding the sleeves in said transferred position while moving the containers and sleeves partway through a narrow band of heat directed onto a zone of the sleeves and sufficient to shrink said sleeves annularly at said zone for holding the sleeves in said position on the containers during subsequent movement along the first path, and thereafter moving the containers and sleeves held thereon in said first path through a heating zone wherein the sleeves are sufficiently heated to completely shrink them snugly over the container exterior surface.
10. The method comprising placing a sleeve of a shrinkable plastic material telescopically over a container, the sleeve having a property of major orientation in the circumferential dimension and the inside circumferential dimension being slightly greater than the external peripheral dimension of the container, said sleeve being relatively loosely fitted along the body of the container, applying a first heat to the exterior of said telescopically disposed sleeve in a zonal region that is juxtaposed over the container sufficient to initially shrink the plastic material in said zonal region into an annular peripheral engagement with said container and hold the sleeve in place thereon, and thereafter heating the entire sleeve and container portion covered thereby sufficiently to shrink the plastic sleeve into an overall snug conforming relationship in surface engagement on the container providing an encircling plastic covering thereon.
11. The method of claim 10, wherein the container comprises a glass container.
12. The method of claim 10, wherein the plastic material comprises a foamed and highly oriented polystyrene material in the range of 0.010 to 0.018 inches in thickness when in form of the unshrunken sleeve.
13. The method of claim 12, wherein the zonally applied first heating step comprises directing an elongated narrow stream of heated air disposed along the said first path against said region of the sleeve, said air being in the range of 200—900° F.
14. The method of claim 10, wherein the plastic material is a foamed and highly oriented polyethylene material in the range of 0.010 to 0.015 inches in thickness.
15. A method comprising the steps of encircling a body portion of a container article with a hollow, substantially cylindrical sleeve of a heat-shrinkable plastic material, heating an annular region of the sleeve that is disposed over said body of the container sufficiently to shrink said sleeve thereat into a gripping contact with said container body for holding the sleeve in position thereon, and thereafter heating said sleeve to shrink it into contact with the container so as to tightly encircle the container over the portions thereof adjacent said sleeve.
16. The method of claim 15, wherein the container comprises a glass bottle or jar.
17. The method of claim 16, wherein the sleeve is comprised of a heat shrinkable foamed thermoplastic material selected from the group consisting of polystyrene and polyethylene.
18. The method of claim 17, wherein the wall thickness of said sleeve, prior to shrinking, is in the range of 0.008 to 0.018 inch.
19. The method of claim 8, wherein the sleeve and article conveyed in said first path past said zonal heating device are axially rotated during the application of heat by said device.
20. A method of placing a sleeve onto a base article, substantially as hereinbefore described with reference to the drawings.
21. Apparatus for placing a sleeve onto a base article, substantially as described with reference to the drawings.
22. Sleeved containers, whenever manufactured by a method as claimed in any of claims 8 to 20 or in apparatus as claimed in any of claims 1 to 7 and 21.

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 Sheet 1

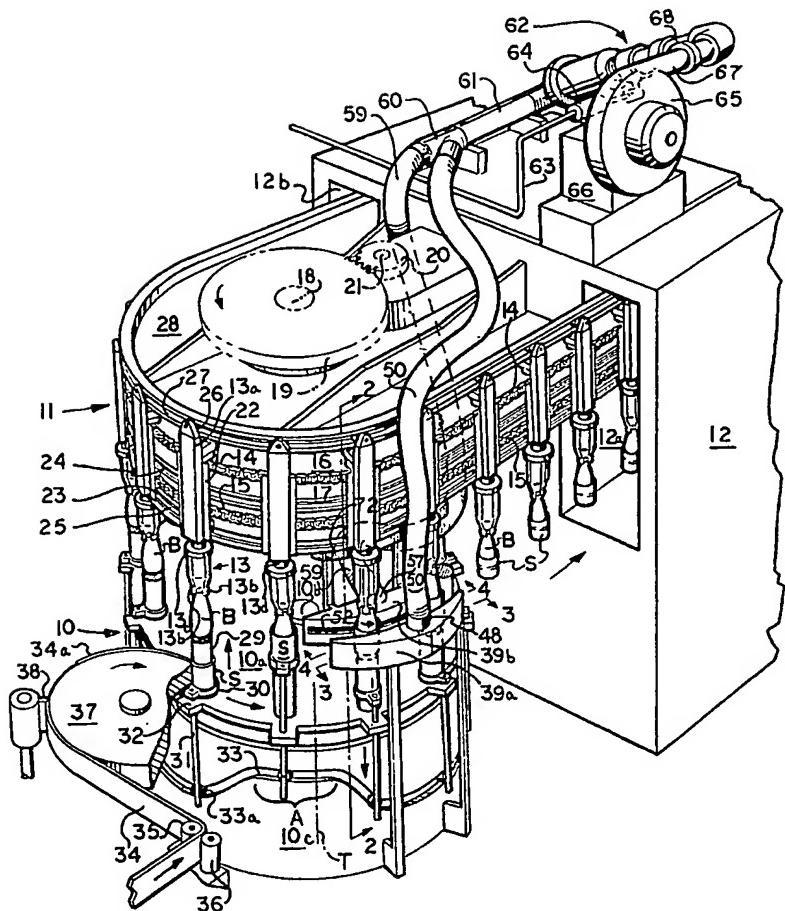


FIG. I

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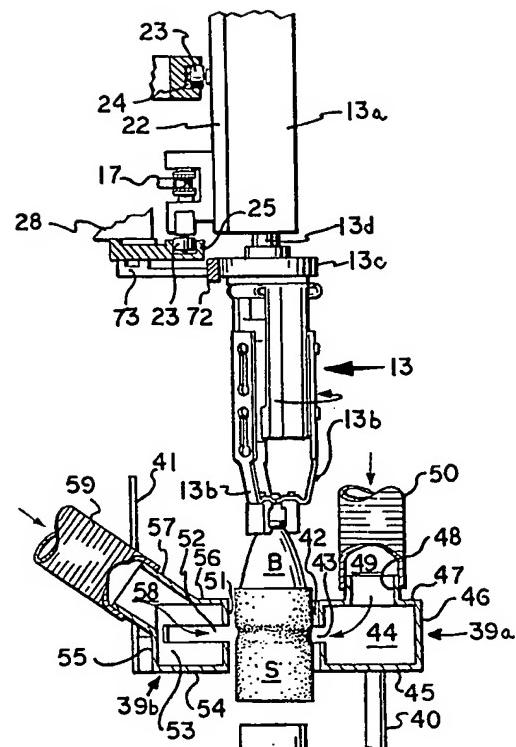
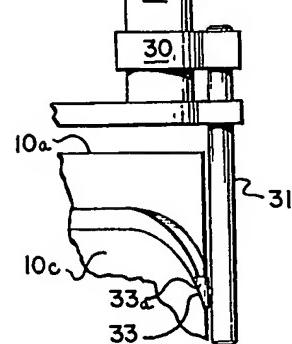


FIG. 2



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 Sheet 3

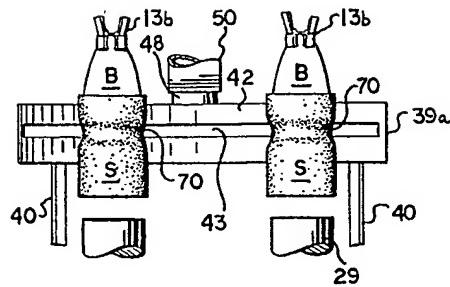


FIG. 3

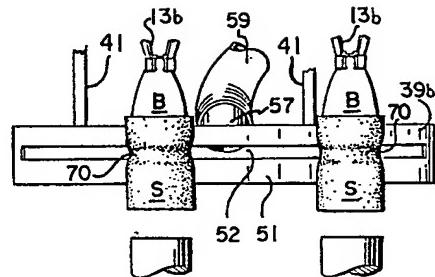


FIG. 4

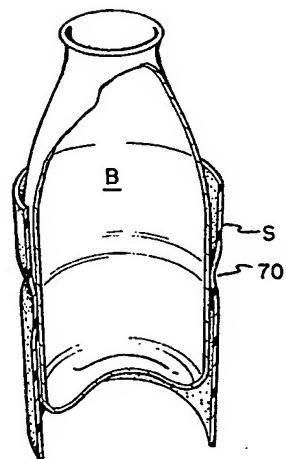


FIG. 5